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The broken thermometer was the earliest constructed upon the plan now proposed, and it was consequently not quite so well finished as subsequent practice has secured for those of later construction. The results of the trial under the higher pressures showed an increase in the amount of compression experienced by the unprotected instruments rising in one instance to as much as  $11^{\circ}5$  F. With the protected instruments the rise did not exceed  $1^{\circ}5$ , due, as before, to the heat evolved from the water by its compression.

A pressure of 3 tons, it may be observed, would be equal to that of 448 atmospheres of 15 lb. upon the square inch; and if it be assumed that the diminution in bulk of water under compression continues uniformly at the rate of 47 millionths of its bulk for each additional atmosphere, the reduction in bulk of water under a pressure of 3 tons upon the square inch will amount to about  $\frac{1}{47}$  of its original volume. This probably is too high an estimate, as the rate of diminution would most likely decrease as the pressure increases.

IV. "Magnetic Survey of the West of France." By the Rev. STEPHEN J. PERRY, F.R.A.S., F.M.S. Communicated by the President.  
Received June 3, 1869.

(Abstract.)

This survey was undertaken by the Rev. W. Sidgreaves and myself in connexion with the Observatory at Stonyhurst College. The instruments employed were those in constant use for the monthly observations of the magnetic elements at this observatory, *i. e.* Barrow's dip-circle, No. 33, a unifilar by Jones, and Frodsham's chronometer, No. 3148. A portable altazimuth and an aneroid barometer were kindly placed at our disposal by the late Mr. Cooke.

A complete set of observations of the dip, declination, and horizontal intensity were taken at the following stations:—Paris, Laval, Brest, Vannes, Angers, Poitiers, Bordeaux, Abbadia (near Hendaye), Loyola, Bayonne, Pau, Toulouse, Périgueux, Bourges, Paris (a second time), and Amiens. The chronometer was compared on every possible occasion, and its rate was found to be nearly always  $2^s$  per day.

The dip was observed according to the description of the observation given by the President of the Royal Society in the 'Manual of Scientific Inquiry.'

The method of vibrations and deflections was invariably adopted for determining the horizontal component of the intensity. For the declination it was deemed most convenient to find the azimuth of a fixed mark by observing transits of the sun with Cooke's altazimuth, and then to measure the azimuthal angle between the magnet and the fixed mark with Jones's unifilar. Dr. Lloyd's method, by reflection, was made use of only at Brest. The results of these observations, reduced to the epoch January 1st, 1869, are contained in the following Table:—

	Dip.	Decl.	H. F.
Paris .....	65° 8' 75	17° 8' 41	4° 1' 133
Laval .....	65° 8' 02	19° 0' 73	4° 1' 245
Brest .....	66° 4' 60	21° 0' 05	4° 0' 442
Vannes .....	65° 5' 85	20° 2' 25	4° 1' 328
Angers .....	65° 1' 40	19° 0' 93	4° 2' 106
Poitiers .....	64° 4' 68	18° 3' 06	4° 2' 955
Bordeaux .....	63° 3' 83	18° 2' 09	4° 4' 110
Abbadia .....	62° 4' 63	18° 2' 35	4° 5' 456
Bayonne .....	62° 5' 03	18° 3' 91	4° 5' 520
Pau .....	61° 9' 70	17° 8' 25	4° 5' 823
Toulouse .....	62° 0' 18	17° 1' 22	4° 5' 883
Périgueux .....	63° 3' 98	17° 6' 82	4° 4' 268
Bourges .....	64° 5' 43	17° 0' 03	4° 2' 845
Amiens .....	66° 6' 72	18° 3' 16	4° 0' 143
Secular Variation . . .	-3' 68	$\left( \begin{array}{c} +0\cdot0050 \\ 0\cdot00002 \end{array} \right)_2 \left( \begin{array}{c} -9\cdot1 \\ 0\cdot19 \end{array} \right)_1$	
Acceleration .....	0·043		

The secular variation has been obtained by comparing the observations of this survey with those of Dr. Lamont, taken about ten years previously.

Maps of the isodynamic, isoclinal, and isogonic lines of the epoch, September 1st, 1868, are drawn from the following data, Paris being chosen as the central station for reasons given in the paper:—

For the isoclinals the direction is

N. 73° 25' 10" E. to S. 73° 25' 10" W.,

the distance between the lines being 44·25 geographical miles for a change of 30' of dip.

The direction for the isogonics is

N. 20° 31' 16" E. to S. 20° 31' 16" W.,

and the distance only slightly greater than for the isoclinals, *i. e.* 44·35 geographical miles for 30' of angle.

The isodynamics lie in the direction

N. 70° 34' 13" E. to S. 70° 34' 13" W.,

the distance in this case being 115 geographical miles for a change of 0·1 in the intensity.

For the lines of equal horizontal force the direction is

N. 74° 19' 30" E. to S. 74° 19' 30" W.,

and 72 geographical miles the distance separating lines where the horizontal intensity differs by 0·1.

An attempt has been made to apply a correction for the magnetic disturbances at the times of observation by means of the magnetograms obtained at Stonyhurst Observatory during the Survey; but these corrections have not been taken into account in forming the equations of condition from which the final results have been obtained.

The probable error of any single observation of the dip, declination, total force, and horizontal component are found to be respectively

3'·13; 0'·95; 0·0144; and 0·0067.